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10AU63

**Sixth Semester B.E. Degree Examination, Jan./Feb. 2021**  
**Design of Machine Elements – II**

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions, selecting atleast TWO questions from each part.**

**PART – A**

- 1 a. Derive an expression for normal stresses due to bending at extreme fibers on the cross-section of a curved beam with assumptions made. (08 Marks)
- b. Determine the maximum tensile stress and max shear stress of the component shown in Fig.Q1(b) and show the stress distribution clearly.

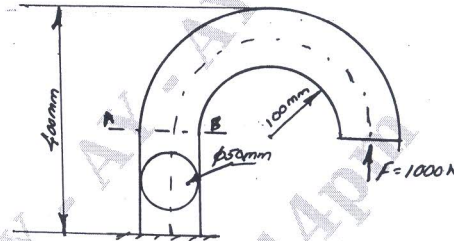


Fig.Q1(b)

(12 Marks)

- 2 a. Write a short note on compound cylinder. (02 Marks)
- b. A cylinder is provided with a flat circular steel plate head of 500mm diameter and is supported around the edge. It is subjected to a uniform pressure of  $5\text{N/mm}^2$ . The allowable working stress for the material is  $70\text{N/mm}^2$ . Poisson's ratio 0.3. Determine :
  - i) Thickness of thick cylinder wall
  - ii) Thickness of circular flat cylinder head. (04 Marks)
- c. A high pressure cylinder consists of a steel tube with inner and outer diameter of 120mm and 160mm respectively. It is jacketed by an outer tube with an outer dia 200mm. The tubes are assembled by a shrinking process in such a way that maximum principal stress induced is  $36.45\text{N/mm}^2$ . The assembly is subjected to an internal fluxed pressure of  $60\text{N/mm}^2$ . Determine :
  - i) Shrinkage pressure
  - ii) Resultant tangential stress and plot the stress distribution. (14 Marks)
- 3 a. Design a spring used in a recoil system so as to absorb 120N-m of energy with a maximum force of 3000N. Assume spring index 8, FOS = 2,  $\tau_y = 0.55\text{GPa}$  and  $G = 79.34\text{GPa}$ . (08 Marks)
- b. Write a short note on NIPPING. (04 Marks)
- c. Design a leaf spring for following specification for a truck. Total load = 120kN. Number of spring = 4, permissible stress is 0.55GPa. Span of spring = 1100mm, width of centre band = 100mm and allowable deflection 80mm. Number of full length leaves 2, number of graduated leaves 6. Assume  $E = 206.92\text{GPa}$ . (08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- 4 a. Derive an expression for torque transmitted by disc for uniform pressure theory/plate clutch. (05 Marks)
- b. Determine the power transmitted by a single power plate clutch assuming uniform pressure distribution. The friction surface has an outside dia of 350mm and inner dia of 280mm. The speed 1000rpm, coefficient of friction is 0.25 and max allowable pressure is 0.85MPa. (05 Marks)
- c. A simple band brake operates on a drum 600mm in diameter that is running at 200rpm while absorbing 15KW of power. The coefficient of friction is 0.25. The brake band has a contact of  $270^\circ$  and one end is fastened to a fixed pin and the other end to the brake arm 125mm from the fixed pin. The straight brake arm is 750mm long and is placed perpendicular to the diameter that bisects the angle of contact.  
Determine :  
i) Maximum effort required to stop the rotation of drum  
ii) Width of 2.5mm thick steel band, if the maximum tensile stress in it not be exceed 56MPa  
iii) Design the lever.  
Assume C40 steel and FOS = 3. (10 Marks)

## PART - B

- 5 a. Write a short advantages of Helical gears over spur gears. (02 Marks)
- b. A pair of carefully cut spur gears with  $20^\circ$  full depth involutes profile is used to transmit 12kN at 1200 rpm revolutions per minute of pinion. The gear has to rotate at 300rpm. The material used for both pinion and gear is medium carbon steel whose allowable bending stress may be taken as 230MPa. Determine module and face width of the spur pinion and gear. (08 Marks)
- c. Design a pair of helical gears to transmit power of 15kN at 3200rpm with speed reduction 4 : 1 pinion is made of cast steel 0.4%C untreated. Gear is made of high grade CI. Helix angle is limited to  $26^\circ$  and not less than 20 teeth are to be used on either gear. Suggest suitable surface hardness for gear pair. (10 Marks)
- 6 Design a pair of bevel gears to connect two shafts at  $60^\circ$ . The gears are alloy steel of case hardened and precision cut with form cutters. The gear ratio is 5 : 1. The power transmitted is 30KW at 900rpm of the pinion. The teeth are  $20^\circ$  face depth. The pinion has 24 teeth. Suggest suitable surface hardness. (20 Marks)
- 7 a. Write a short note on Hydrodynamic lubrication. (04 Marks)
- b. Derive the Petroff's equation with assumption made. (06 Marks)
- c. Design the main bearings of a steam turbine that runs at 1800rpm. The load on the bearings is estimated to be 2500N. (10 Marks)
- 8 a. Design a belt drive to transmit 25KW from a motor shaft rotating at 1500rpm to a compressor running at 500rpm. The motor pulley is 96mm effective diameter and the centre distance between the shafts is 1.5m. (10 Marks)
- b. Write a short note on classification of rope driver. (04 Marks)
- c. A 20mm  $8 \times 19$  steel wire rope is used with a hoisting drum of 1m diameter to lift a load of 20kN. The depth of mine is 800m and the acceleration is  $3\text{m/sec}^2$ . Determine the number of ropes required using a factor of safety 5. Neglect weight of skip. (06 Marks)

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